



# Stainless Steel Capillary Columns and Tubing

## Ultra Alloy® Capillary Columns, Stainless Steel or Fused Silica?

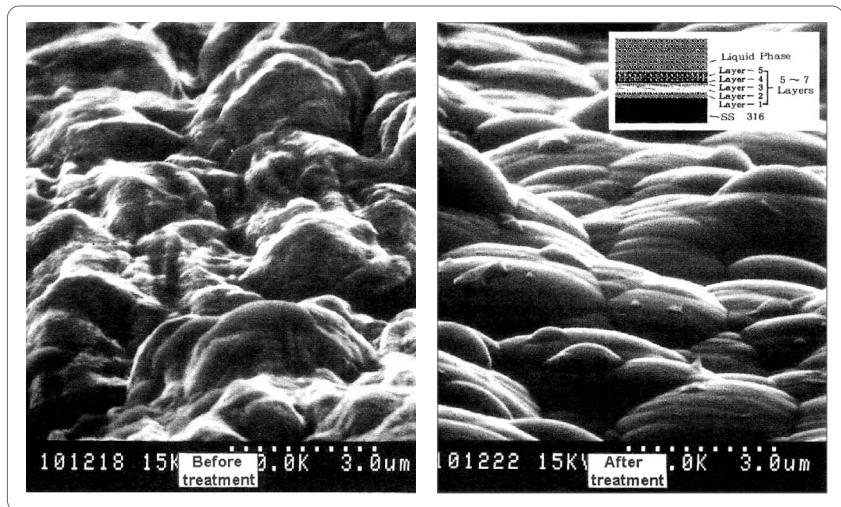
Ultra ALLOY® metal capillary columns are characterized by their inertness, high temperature stability and mechanical durability.

A high heat and contamination resistant column with a proprietary deactivation treatment on the inner surface of the stainless steel tube. It is more heat resistant than fused silica columns and can be used at 450 °C. In addition to low bleed and long life, there are many other benefits such as (1) prevention of column deterioration due to oil in the sample, (2) solvent-free cleaning, (3) low ghost peaks, (4) saving analysis time, and (5) high performance sustainability.

Employing a slanted-multi-layer structure on a Stainless Steel (SS) column surface, Ultra ALLOY® capillary columns have been paid much attention, and are replacing conventional columns based on fused silica (FS), which has been considered as the ultimate material. The following ten Q&A's feature the high performance.

**Q1:** Capillary columns have evolved from Golay (SS) column, then to glass, and to FS. Why SS column now? What is the difference between FS and SS besides the materials? Please describe it using a methylsilicone column as an example among many others.

Your concern is very natural. Although we have developed the columns, there are some areas that we cannot explain. Iron atoms in SS are known to adsorb hydrocarbons and polar components. However, if the surface can be completely covered by an inert layer, SS will be an ideal material for capillary columns. Because SS is a metal, it has high flexural, abrasion, impact, and thermal resistances. Use of SS and our advanced proprietary column pretreatment technology have made it possible to develop the Ultra ALLOY columns and we are the center of world attention.



**Figure 1.** SEM images of stainless steel column surface before and after multi-layer pretreatment.



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**Q2: How was the metal surface pretreated?**

We have succeeded in forming a multi-layer structure (5-7 layers each less than 0.001 micron) on the surface of SS column as shown in the SEM pictures in the front cover page (patent applied for). These layers are chemically bonded to each other, and the chemical structure of the top layer can be modified depending on the kind of liquid phase. We wanted to limit the number of layers to 3, but we found at least 5 layers were required in order to outperform the FS column performance. Our top grade columns have 7 layers to provide highest inertness.

**Q3: What about the absorption of primary amines which are known to be the problems with ODS columns used in HPLC? Is the analysis difficult with FS columns due to tailing problems?**

That's a hard question. Only Hewlett Packard, known to supply high performance products, has done the tests on this. We have challenged them with Ultra ALLOY® 1. Figure 1 shows the performance comparison with Brand (J). When 5mg of a sample was used in heating program mode, ours clearly outperforms. The pyrolysis of Nylon-12.6 is known to give peaks due to various amines, shown in Figure 5. These peaks are extremely difficult to separate with FS columns.

**Q4: The internal surface of a SS capillary column has less than 10µm (peak to valley) roughness. The thickness of liquid phase at the peak is small, while that at the valley is large. Does this affect peak separation?**

Yes, it does. As the liquid phase becomes very thin, the top layer of the slanted 5 layer structure emerges, causing problems. We found 3 layer surface pretreatment of the SS column to be inadequate due to the effects from the metal surface; therefore, 5 layer pretreatment was necessary to solve the problem. The coating efficiency is about 90% and is comparable to FS columns. The SEM picture shown in the front cover page clearly shows the improved surface structure.

**Q5: I hear that Ultra ALLOY® columns have high thermal stability; however, I rarely heat up to 250°C. I do not think such high temperature stability is necessary, because I thoroughly pretreat samples before analysis. Does it still have any advantages?**

Yes, it does. Advantages of high thermal stability of a column are: (1) low bleeding and high durability; (2) protection against column degradation by nonvolatiles from samples; (3) cleaning of columns without use of solvents and guarding against ghost peaks - allowing great time saving; and (4) high data reproducibility over extended period of time.

Samples normally contain a minute amount of nonvolatile species as impurities. Such species deposit over the column inlet or the entire column, they can act as the liquid phase and cause peak broadening and adsorption. Triglycerides and mineral oil are the common high boiling impurities, and they can be eluted off the column by baking at high temperatures (380-400°C). Cumbersome solvent cleaning steps (removing column, cleaning, drying, mounting column, and baking) are not required, if columns

are baked at the end of a day. Another advantage is that it is effective in reducing ghost peaks due to high boiling species remained in the column, leading to great saving of analysis time. The high degree of durability means that the analysis is reliable and the data are reproducible over an extended period of time. Figure 2 shows a comparison of column degradation by blending 5% rapeseed oil in a sample. The internal surface area of our SS columns is 10-20 times greater than that of FS columns; thus, oil components are difficult to diffuse. As a result, SS columns have high resistance against contamination.

**Q6: Is the lot-to-lot reproducibility good?**

Yes, it is. Ultra ALLOY columns are quality checked by retention indices, partition ratios, coating efficiency, and the use of polar species for inertness. Table 1. shows the reproducibility of the columns.

**Q7: How small can a column be coiled? We would like to condense a sample using a liquid nitrogen trap. FS Megabore columns cannot be coiled so small in diameter.**

You have come up with a good application. If SS columns are coiled slowly, the diameter can be as small as 1 cm. Columns with 0.25 mm inner diameter can be clogged by moisture and solvent condensation, when concentrating sample at liquid nitrogen temperature, but ones with 0.5 mm inner diameter should work without problems. (See Figure 7 for an example)

**Q8: What polar columns do you have?**

There are a variety of polar columns available as tabulated in the last page. See application examples. Liquid phases used in packed columns are available in Ultra ALLOY® columns. Please ask for details. PyGC, triglyceride and PEG20M (with KOH) columns are also available for specific applications.

**Q9: What precautions do you recommend for GC/MS applications? With a quadruple type MS, the column outlet can be inserted to the ion source, but with a magnetic type, a jet separator should be used, or alternatively, a length (50 cm) of a FS column (P/N:PY1-2210) should be connected at the column outlet.****Q10: I have seen SS columns internally coated with fused silica in the U.S. If bent, do you think the FS breaks and metal surface is exposed?**

FS coating was considered in our lab at the early stage of development, but we found FS on the internal surface would break easily when columns were bent as you speculated Figure 6 shows that a commercial FS coated columns becomes very active when the internal FS coating breaks and comes off from the metal surface, exposing the metal surface. Because of the reasons above, Frontier Lab does not employ the FS coating method, although the manufacturing cost is less. Currently our inert tubing is extensively used as an interface in various purge & trap TG/ MS and GC/MS.

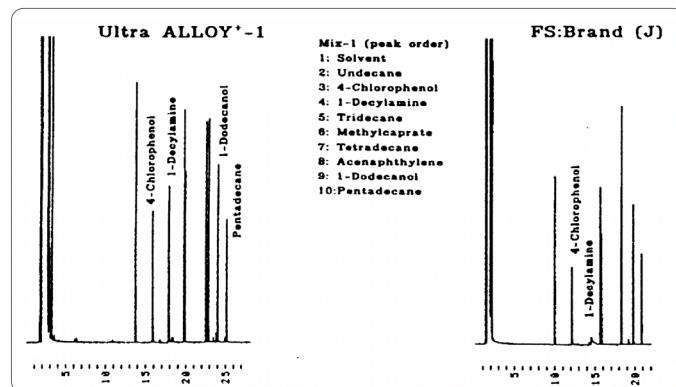
**Table 1.** Lot-to-lot Reproducibility (n=30 for each year) Column: UA-1(HT), 100% dimethylpolysiloxane, 30 m (0.25Ø), 0.15 µm at 130 °C.

	1993		1994		1995	
	RI	CV (%)	RI	CV (%)	RI	CV (%)
Methylcaprate	1305.4	0.018	1305.5	0.017	1305.6	0.015
Acenaphthalene	1418.7	0.021	1419.1	0.022	1419.7	0.022
1-dodecanol	1456.1	0.009	1456.1	0.008	1456.0	0.006
Column Efficiency (%)	82.3	2.010	83.4	1.970	87.2	1.720

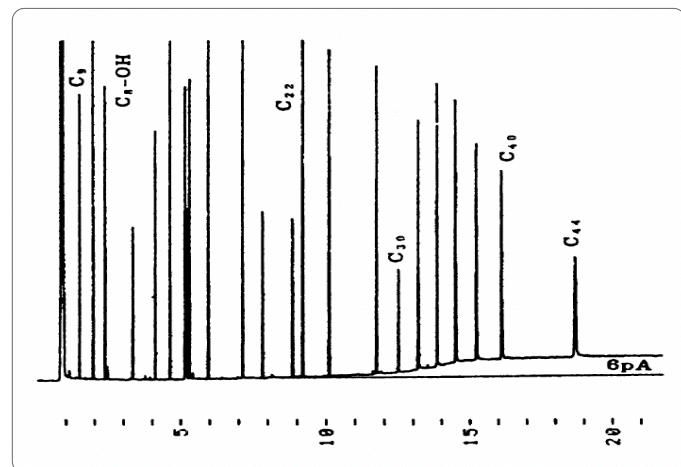
RI: Retention Index

## Basic Performance

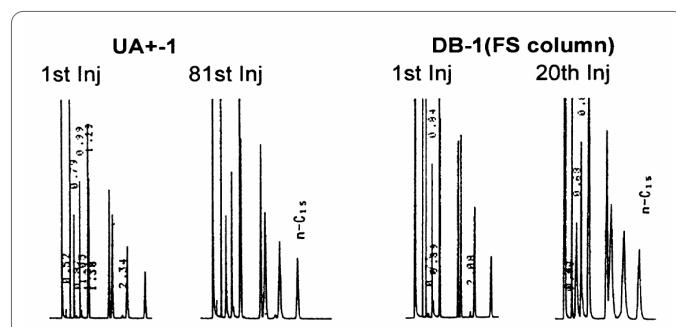
Applications featuring high inertness, high contamination resistance, high thermal resistance, low bleeding, and high durability



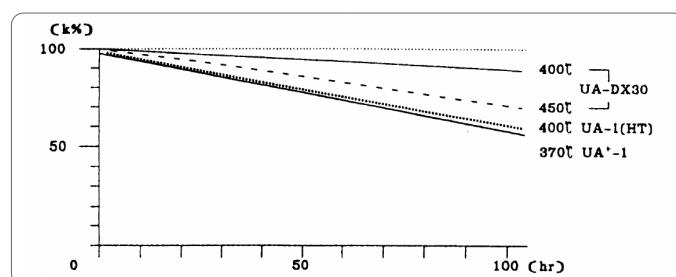
**Figure 1. Activity Comparison of Ultra ALLOY®-1 and Fused Silica (FS) Columns.** 30m (0.25Ø) 0.25 µm, programmed from 40°C to 220°C at 5°C/min



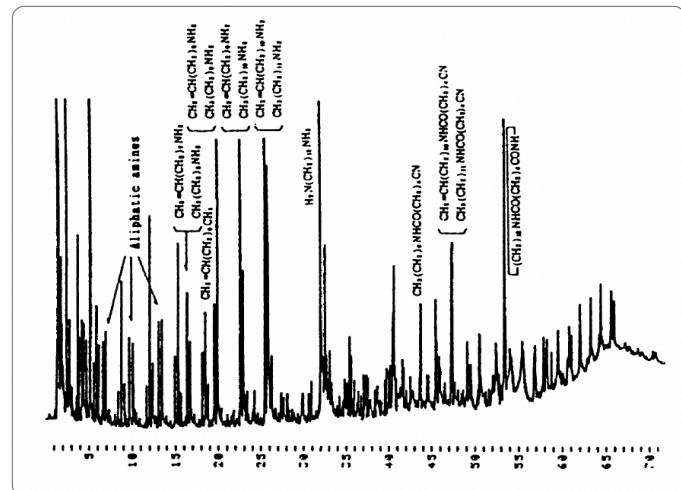
**Figure 4. Low Bleeding (UA-5: 6pA at 350°C).** 15m (0.25 mmØ) 0.25 µm at 70 to 350°C at 20°C/min, Split at 300°C



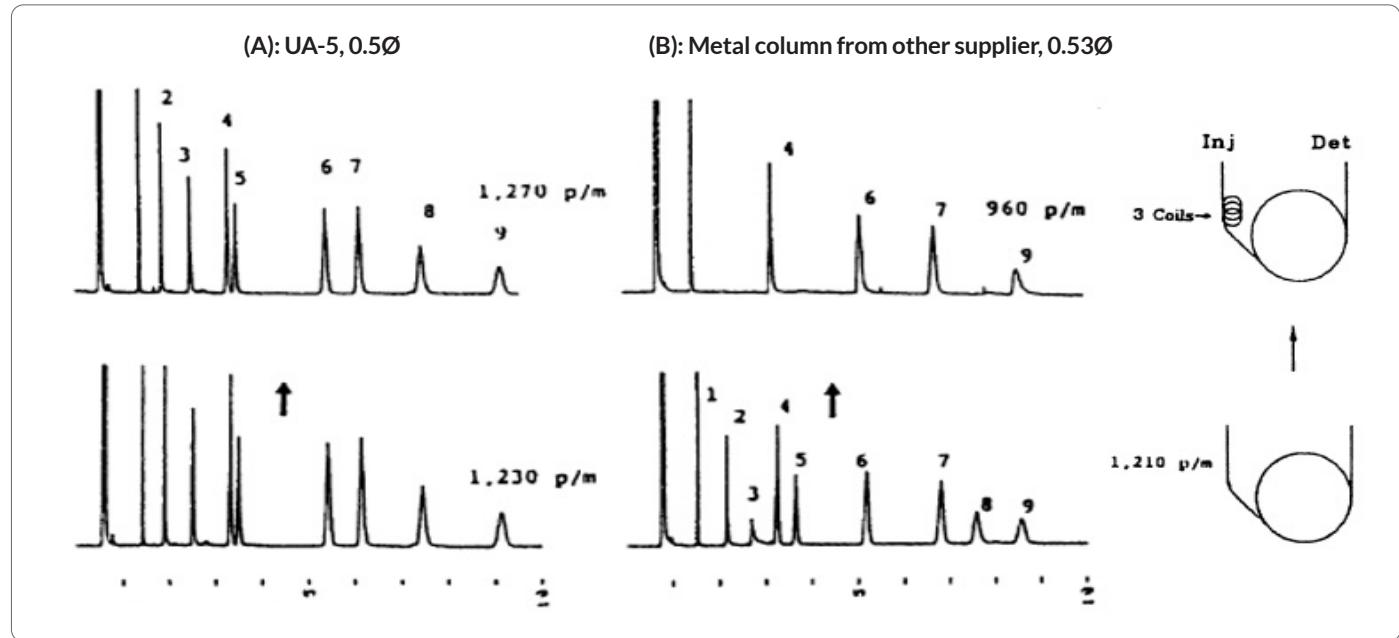
**Figure 2. High Contamination Resistance (consecutive injection of a sample containing 5% rapeseed oil).** UA-1 (10m (0.25Ø) 0.25 µm at 120°C, Split at 250°C)



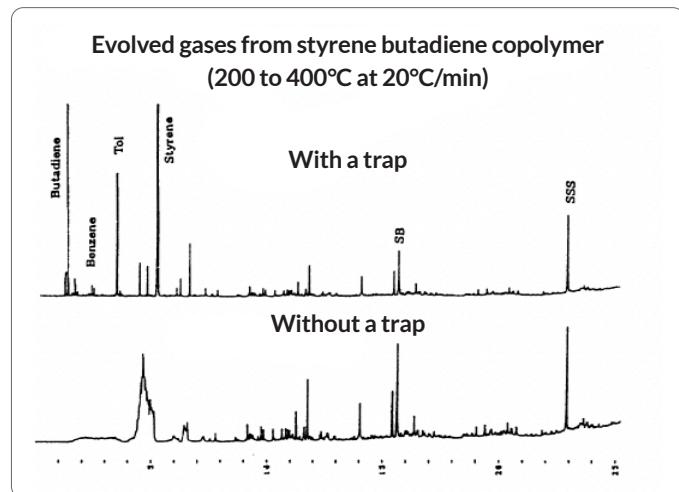
**Figure 3. Thermal Stability change in capacity ratio (k) upon continuous exposure to high temperatures.** Column: UA-DX30, UA-1(H/T), 15m (0.25Ø) 0.15 µm (Because the stationary phases are physically bonded to the rough column internal surface as shown in the SEM picture in the front cover page, our products offer high maximum temperatures and durability.)



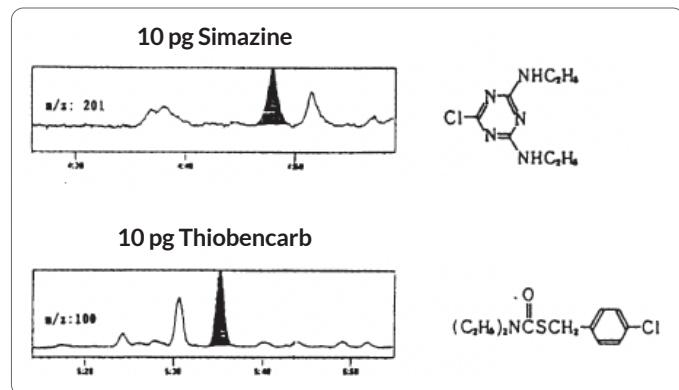
**Figure 5. Inertness (PyGC of Nylon 12-6): UA-PY2.** (Various primary amines from pyrolysis are eluted off). Pyrolysis at 550°C, 30m (0.25Ø) 0.5µm, 40–360°C at 5°C/min, Split at 300°C.



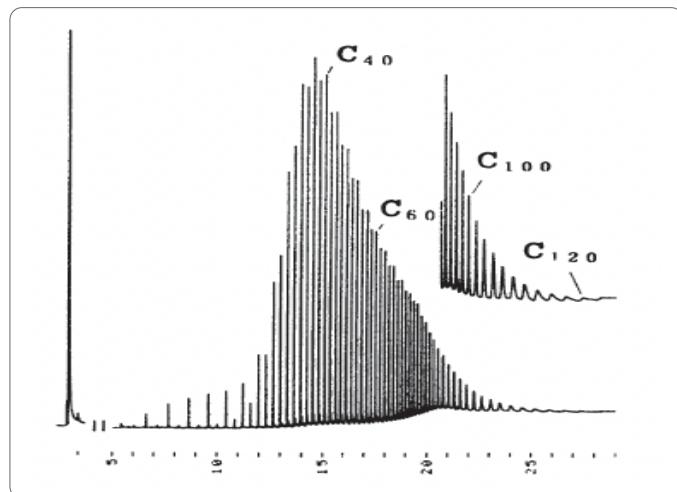
**Figure 6. Comparison with USA Products: UA-5.** Column activity with a coiled column at the inlet (3 turns / 3cm in diameter) with Column (B), polar species are adsorbed when the internal silica coating came off. 15m, 0.5 µm at 120°C. Sample is the same as in Figure 1.



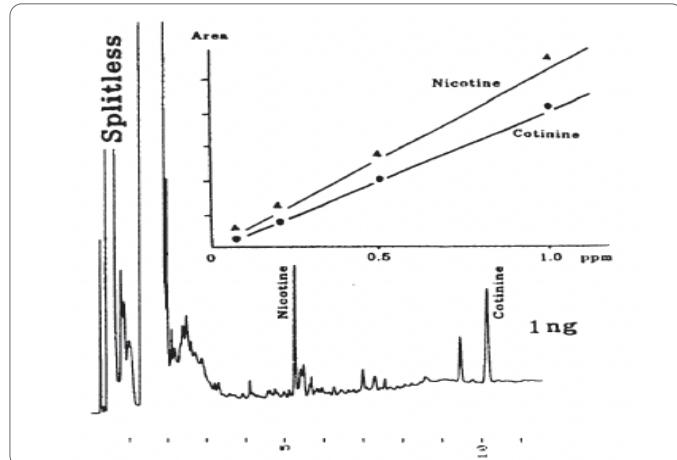
**Figure 7. Use of Gas Trap: UA-1.** A length of a column at the edge was coiled (2 cm in diameter) and was immersed in liquid N<sub>2</sub>. Evolved gases from pyrolysis were trapped for 10 min. 30m (0.25Ø) 0.5 µm, 30 to 250°C at 10°C/min



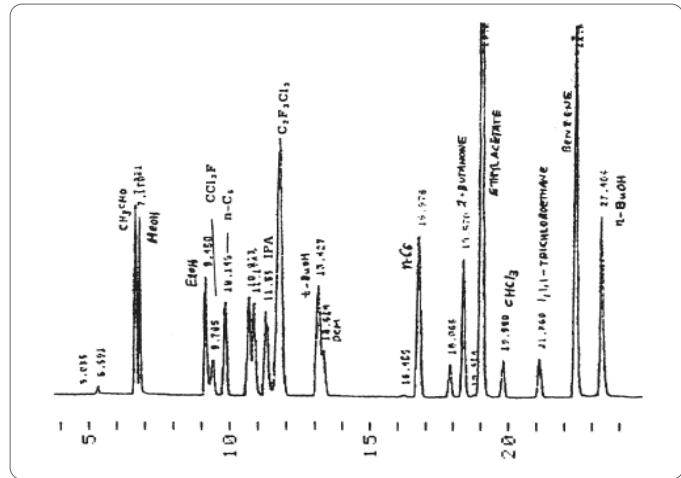
**Figure 8. A trace amount of agricultural chemicals: UA-<sup>+1</sup>(S)**  
15m (0.25Ø) 0.25 µm, 60 to 320°C at 15°C/min



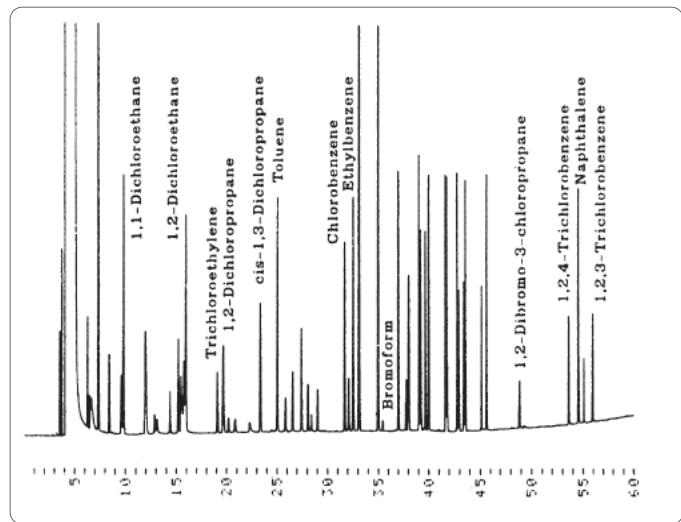
**Figure 9. Wax: UA-DX-30.** 15m (0.5Ø) 0.15µm, 50°C to 440°C at 20°C/min, On-column



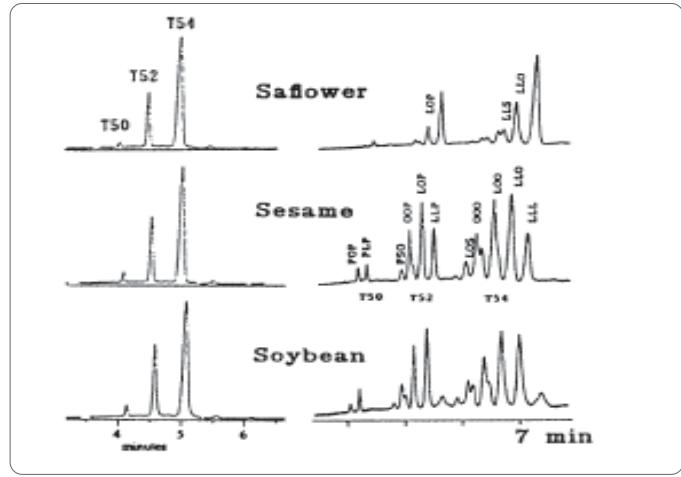
**Figure 10. A trace amount of nicotines: UA-WAX (KOH).** (Effective for basic species). 5m (0.25Ø) 0.25 µm, 50 to 220°C at 20°C/min



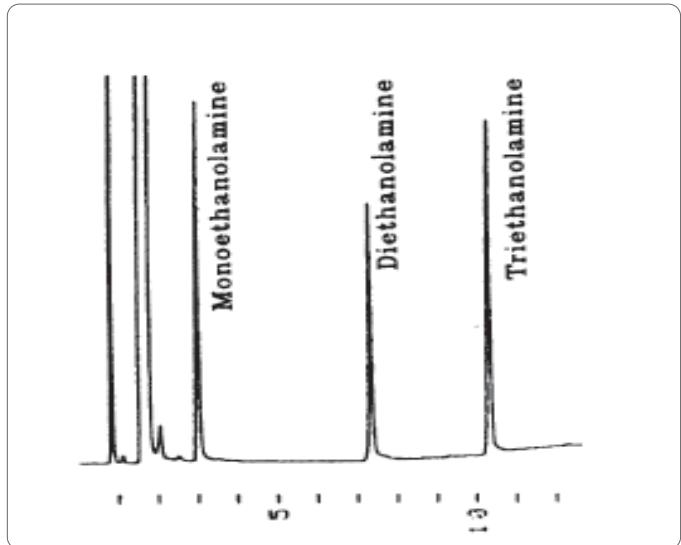
**Figure 11. Column used by NASA: UA-502.** (The column is recoiled into 3 cm diameter, and will be used in a space shuttle.) 60m (0.5Ø) 3 µm, 40°C hold for 12 min, then to 150°C at 6°C/min.



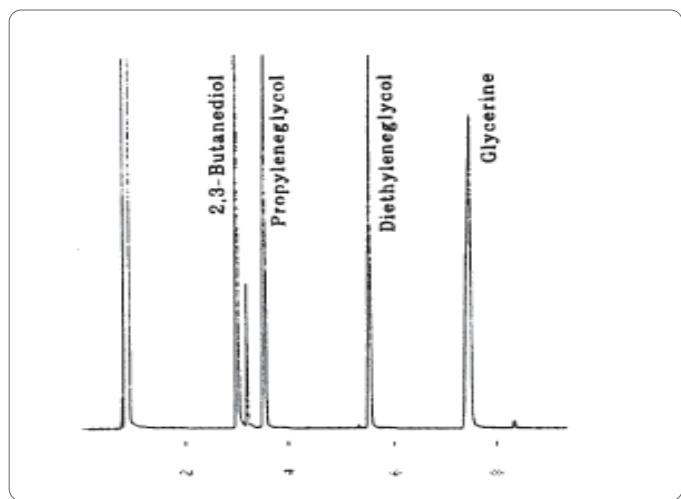
**Figure 12. Volatiles in drinking water: UA-624.** (1/10 of bleeding compared to other supplier's in GC/MS applications, this is gaining popularity among users.) 60m (0.25Ø) 1 µm, 10 min hold at 30°C, then to 200°C at 3°C/min



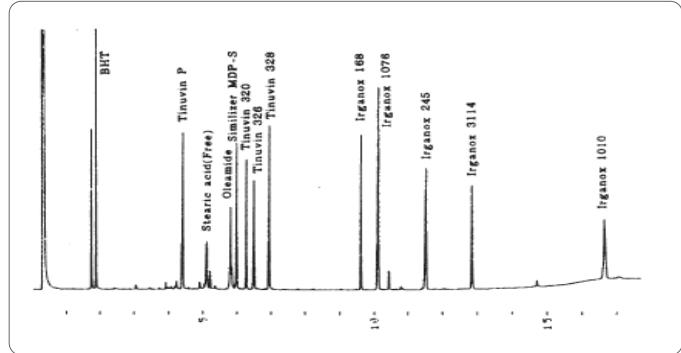
**Figure 13. Triglyceride: UA+ -65/UA-DX30.** Column: 300 to 350°C at 20°C/min, then conditions shown below used (split). DX30, 15m(0.250)0.15µm 350 to 400°C at 10°C/min UA-65, 15m(0.25)0.5µm 350 to 360°C at 1°C/min



**Figure 13.18 Ethanol amines: UA\*-1.** 15m (0.5Ø) 5 µm, split, 50 to 230°C at 20°C/min



**Figure 14. Multifunctional alcohols: UA-WAX.** 15m (0.25Ø)  
0.25 µm, 80 to 200°C at 20°C/min



**Figure 15.20 Polymer additives: UA-PY3.** 10m(0.25Ø) 0.15µm, 100 to 420°C at 20°C/min, Split at 380°C

## Ultra ALLOY Metal Capillary Columns

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column, UA1(MS/HT)-15 m x 0.25 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.1µm	450°C	CH-100049
Ultra ALLOY Metal Capillary Column, UA1(MS/HT)-15 m x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.25µm	450°C	CH-100050
Ultra ALLOY Metal Capillary Column, UA1(MS/HT)-15 m x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.5µm	420°C	CH-100051
Ultra ALLOY Metal Capillary Column, UA5(MS/HT)-15 m x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.1µm	430°C	CH-100052
Ultra ALLOY Metal Capillary Column UA5(MS/HT)-15 m x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.25µm	430°C	CH-100053
Ultra ALLOY Metal Capillary Column UA5(MS/HT)-15 m x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.5µm	420°C	CH-100054
Ultra ALLOY Metal Capillary Column UADX30-15 m x 0.25 mm ID, 0.15µm Film	Carborane-siloxane	Micropolarity	0.25 mm	15 m	0.15µm	450°C	CH-100055
Ultra ALLOY Metal Capillary Column UA1(MS/HT)-30M x 0.25 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.1µm	450°C	CH-100056
Ultra ALLOY Metal Capillary Column UA1(MS/HT)-30M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.25µm	450°C	CH-100057
Ultra ALLOY Metal Capillary Column UA1(MS/HT)-30M x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.5µm	420°C	CH-100058
Ultra ALLOY Metal Capillary Column UA5(MS/HT)-30M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.1µm	430°C	CH-100059
Ultra ALLOY Metal Capillary Column UA5(MS/HT)-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.25µm	430°C	CH-100060
Ultra ALLOY Metal Capillary Column UA5(MS/HT)-30M x 0.25 mm ID, 0.50µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.5µm	420°C	CH-100061
Ultra ALLOY Metal Capillary Column UADX30-30M- x 0.25 mm ID, 0.15µm Film	Carborane-siloxane	Micropolarity	0.25 mm	30 m	0.15µm	450°C	CH-100062
Ultra ALLOY Metal Capillary Column UA1(MS/HT)-60M x 0.25 mm ID, 0.25µm Film	Carborane-siloxane	Micropolarity	0.25 mm	60 m	0.25µm	450°C	CH-100063
Ultra ALLOY Metal Capillary Column UADX30-60M x 0.25 mm ID, 0.15µm Film	Carborane-siloxane	Micropolarity	0.25 mm	60 m	0.15µm	450°C	CH-100064
Ultra ALLOY Metal Capillary Column UA1-15 m x 0.25 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.1µm	380°C	CH-100065
Ultra ALLOY Metal Capillary Column UA1-15 m x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.25µm	380°C	CH-100066
Ultra ALLOY Metal Capillary Column UA1-15 m x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.5µm	380°C	CH-100067
Ultra ALLOY Metal Capillary Column UA1-15 m x 0.25 mm ID, 1.0µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	1.0µm	330/360°C	CH-100068
Ultra ALLOY Metal Capillary Column UA5-15 m x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.1µm	380°C	CH-100069

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA5-15 m x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.25µm	380°C	CH-100070
Ultra ALLOY Metal Capillary Column UA5-15 m x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.5µm	380°C	CH-100071
Ultra ALLOY Metal Capillary Column UA5-15 m x 0.25 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	1.0µm	330/360°C	CH-100072
Ultra ALLOY Metal Capillary Column UA65-15 m x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.1µm	380°C	CH-100073
Ultra ALLOY Metal Capillary Column UAWAX-15 m x 0.25 mm ID, 0.25µm Film	Polyethyleneglycol	Strong polarity	0.25 mm	15 m	0.25µm	260°C	CH-100074
Ultra ALLOY Metal Capillary Column UAPY3-10M x 0.25 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	10 m	0.1µm	420°C	CH-100075
Ultra ALLOY Metal Capillary Column UA1-30M x 0.25 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.1µm	380°C	CH-100076
Ultra ALLOY Metal Capillary Column UA1-30M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.25µm	380°C	CH-100077
Ultra ALLOY Metal Capillary Column UA1-30M x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.5µm	380°C	CH-100078
Ultra ALLOY Metal Capillary Column UA1-30M x 0.25 mm ID, 1.0µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	1.0µm	330/360°C	CH-100079
Ultra ALLOY Metal Capillary Column UA5-30M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.1µm	380°C	CH-100080
Ultra ALLOY Metal Capillary Column UA5-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.25µm	380°C	CH-100081
Ultra ALLOY Metal Capillary Column UA5-30M x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.5µm	380°C	CH-100082
Ultra ALLOY Metal Capillary Column UA5-30M x 0.25 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	1.0µm	330/360°C	CH-100083
Ultra ALLOY Metal Capillary Column UA35-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100084
Ultra ALLOY Metal Capillary Column UA65-30M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.1µm	380°C	CH-100085
Ultra ALLOY Metal Capillary Column UAWAX-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100086
Ultra ALLOY Metal Capillary Column UA1-60M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	60 m	0.25µm	380°C	CH-100087
Ultra ALLOY Metal Capillary Column UA1-60M x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	60 m	0.5µm	380°C	CH-100088
Ultra ALLOY Metal Capillary Column UA1-60M x 0.25 mm ID1.0µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	60 m	1.0µm	330/360°C	CH-100089
Ultra ALLOY Metal Capillary Column UA5-60M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Micropolarity	0.25 mm	60 m	0.25µm	380°C	CH-100090
Ultra ALLOY Metal Capillary Column UA5-60M x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Micropolarity	0.25 mm	60 m	0.5µm	380°C	CH-100091
Ultra ALLOY Metal Capillary Column UA5-60M x 0.25 mm ID, 1.0µm Film	Dimethyl polysiloxane	Micropolarity	0.25 mm	60 m	1.0µm	330/360°C	CH-100092
Ultra ALLOY Metal Capillary Column UA65-60M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	60 m	0.1µm	380°C	CH-100093
Ultra ALLOY Metal Capillary Column UAWAX-60M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Strong polarity	0.25 mm	60 m	0.25µm	260°C	CH-100094
Ultra ALLOY Metal Capillary Column UAPBDE-15M x 0.25 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.05µm	380°C	CH-100095
Ultra ALLOY Metal Capillary Column UAPHTHA-15M x 0.25 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.05µm	380°C	CH-100096
Ultra ALLOY Metal Capillary Column UA1(S)-15M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.25µm	450°C	CH-100097

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA1(S)-15M x 0.25 mm ID, 0.4µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.4µm	420°C	CH-100098
Ultra ALLOY Metal Capillary Column UA1701-15M x 0.25 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	15 m	0.25µm	380°C	CH-100099
Ultra ALLOY Metal Capillary Column UA1701-15M x 0.25 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	15 m	0.5µm	380°C	CH-100100
Ultra ALLOY Metal Capillary Column UA1701-15M x 0.25 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	15 m	1.0µm	330/360°C	CH-100101
Ultra ALLOY Metal Capillary Column UA50-15M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.1µm	350°C	CH-100102
Ultra ALLOY Metal Capillary Column UA50-15M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.25µm	350°C	CH-100103
Ultra ALLOY Metal Capillary Column UA50-15M x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.5µm	350°C	CH-100104
Ultra ALLOY Metal Capillary Column UA50-15M x 0.25 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	1.0µm	350°C	CH-100105
Ultra ALLOY Metal Capillary Column UAFFAP-15M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.25µm	350°C	CH-100106
Ultra ALLOY Metal Capillary Column UATRG-15M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.1µm	350°C	CH-100107
Ultra ALLOY Metal Capillary Column UASIL-15M x 0.25 mm ID, 0.2µm Film	Cyanopropyl	Strong polarity	0.25 mm	15 m	0.2µm	350°C	CH-100108
Ultra ALLOY Metal Capillary Column UAWAXK-15M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.25µm	350°C	CH-100109
Ultra ALLOY Metal Capillary Column UAPBDE-30M x 0.25 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.05µm	380°C	CH-100110
Ultra ALLOY Metal Capillary Column UAPHHTA-30M x 0.25 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.05µm	380°C	CH-100111
Ultra ALLOY Metal Capillary Column UA1(S)-30M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.25µm	380°C	CH-100112
Ultra ALLOY Metal Capillary Column UA1(S)-30M x 0.25 mm ID, 0.4µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.4µm	380°C	CH-100113
Ultra ALLOY Metal Capillary Column UA1701-30M x 0.25 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100114
Ultra ALLOY Metal Capillary Column UA1701-30M x 0.25 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Strong polarity	0.25 mm	30 m	0.5µm	380°C	CH-100115
Ultra ALLOY Metal Capillary Column UA1701-30M x 0.25 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Strong polarity	0.25 mm	30 m	1.0µm	330/360°C	CH-100116
Ultra ALLOY Metal Capillary Column UA50-30M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.1µm	380°C	CH-100117
Ultra ALLOY Metal Capillary Column UA50-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100118
Ultra ALLOY Metal Capillary Column UA50-30M x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.5µm	380°C	CH-100119
Ultra ALLOY Metal Capillary Column UA50-30M x 0.25 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	1.0µm	330/360°C	CH-100120
Ultra ALLOY Metal Capillary Column UAFFAP-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100121
Ultra ALLOY Metal Capillary Column UA5(P)-D30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100122

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UAPY1-30M x 0.25 mm ID, 0.25µm Film	Polydimethylsiloxane	Nonpolar	0.25 mm	30 m	0.25µm	380°C	CH-100123
Ultra ALLOY Metal Capillary Column UAPY2-30M x 0.25 mm ID, 0.5µm Film	Polydimethylsiloxane	Nonpolar	0.25 mm	30 m	0.5µm	380°C	CH-100124
Ultra ALLOY Metal Capillary Column UA624-30M x 0.25 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	30 m	1.0µm	330/360°C	CH-100125
Ultra ALLOY Metal Capillary Column UADIDP-30M x 0.25 mm ID, 0.4µm Film	Di-isodecylphthalate	Strong polarity	0.25 mm	30 m	0.4µm	380°C	CH-100126
Ultra ALLOY Metal Capillary Column UATRG-30M x 0.25 mm ID0. 10µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	10µm	380°C	CH-100127
Ultra ALLOY Metal Capillary Column UASIL-30M x 0.25 mm ID, 0.2µm Film	Cyanopropyl	Strong polarity	0.25 mm	30 m	0.2µm	380°C	CH-100128
Ultra ALLOY Metal Capillary Column UAWAXK-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100129
Ultra ALLOY Metal Capillary Column UA1(S)-60M x 0.25 mm ID, 0.4µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	60 m	0.4µm	380°C	CH-100130
Ultra ALLOY Metal Capillary Column UA1701-60M x 0.25 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	60 m	0.25µm	380°C	CH-100131
Ultra ALLOY Metal Capillary Column UA1701-60M x 0.25 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	60 m	0.5µm	380°C	CH-100132
Ultra ALLOY Metal Capillary Column UA1701-60M x 0.25 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	60 m	1.0µm	330/360°C	CH-100133
Ultra ALLOY Metal Capillary Column UA50-60M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	60 m	0.1µm	380°C	CH-100134
Ultra ALLOY Metal Capillary Column UA50-60M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	60 m	0.25µm	380°C	CH-100135
Ultra ALLOY Metal Capillary Column UA50-60M x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	60 m	0.5µm	380°C	CH-100136
Ultra ALLOY Metal Capillary Column UA50-60M x 0.25 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	60 m	1.0µm	330/360°C	CH-100137
Ultra ALLOY Metal Capillary Column UAFFAP-60M x 0.25 mm ID, 0.25µm Film	PEG20M (Nitro-TPA ester)	Midpolarity	0.25 mm	60 m	0.25µm	380°C	CH-100138
Ultra ALLOY Metal Capillary Column UA624-60M x 0.25 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	60 m	1.0µm	330/360°C	CH-100139
Ultra ALLOY Metal Capillary Column UADIDP-60M x 0.25 mm ID, 0.4µm Film	Di-isodecylphthalate	Strong polarity	0.25 mm	60 m	0.4µm	150°C	CH-100140
Ultra ALLOY Metal Capillary Column UASIL-60M x 0.25 mm ID, 0.2µm Film	Cyanopropyl	Midpolarity	0.25 mm	60 m	0.2µm	280°C	CH-100141
Ultra ALLOY Metal Capillary Column UAWAXK-60M x 0.25 mm ID, 0.25µm Film	PEG20M (KOH treatment)	Strong polarity	0.25 mm	60 m	0.25µm	260°C	CH-100142
Ultra ALLOY Metal Capillary Column UA1-30MW x 0.32 mm ID, 0.10µm Film	Polydimethylsiloxane	Nonpolar	0.32 mm	30 m	10µm	380°C	CH-100143
Ultra ALLOY Metal Capillary Column UA1(HT)-15W x 0.53 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.1µm	420°C	CH-100144
Ultra ALLOY Metal Capillary Column UA1(HT)-15W x 0.53 mm ID, 0.15µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.15µm	420°C	CH-100145
Ultra ALLOY Metal Capillary Column UA1(HT)-15W x 0.53 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.25µm	420°C	CH-100146
Ultra ALLOY Metal Capillary Column UADX30-15W x 0.53 mm ID, 0.15µm Film	Carborane-siloxane	Micropolarity	0.53 mm	15 m	0.15µm	450°C	CH-100147

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA1(HT)-30W x 0.53 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.1µm	380°C	CH-100148
Ultra ALLOY Metal Capillary Column UA1(HT)-30W x 0.53 mm ID, 0.15µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.15µm	380°C	CH-100149
Ultra ALLOY Metal Capillary Column UA1(HT)-30W x 0.53 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.25µm	380°C	CH-100150
Ultra ALLOY Metal Capillary Column UADX30-30W x 0.53 mm ID, 0.15µm Film	Carborane-siloxane	Micropolarity	0.53 mm	30 m	0.15µm	450°C	CH-100151
Ultra ALLOY Metal Capillary Column UA1-15W x 0.53 mm ID , 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.25µm	380°C	CH-100152
Ultra ALLOY Metal Capillary Column UA1-15W x 0.53 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.5µm	380°C	CH-100153
Ultra ALLOY Metal Capillary Column UA1-15W x 0.53 mm ID, 1.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	1.5µm	380°C	CH-100154
Ultra ALLOY Metal Capillary Column UA1-15W x 0.53 mm ID, 5.0µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	5.0µm	380°C	CH-100155
Ultra ALLOY Metal Capillary Column UA1-30W x 0.53 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.25µm	380°C	CH-100156
Ultra ALLOY Metal Capillary Column UA1-30W x 0.53 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.5µm	380°C	CH-100157
Ultra ALLOY Metal Capillary Column UA1-30W x 0.53 mm ID, 1.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	1.5µm	380°C	CH-100158
Ultra ALLOY Metal Capillary Column UA1-30W x 0.53 mm ID, 5.0µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	5.0µm	380°C	CH-100159
Ultra ALLOY Metal Capillary Column UA1-60W x 0.53 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	60 m	0.25µm	380°C	CH-100160
Ultra ALLOY Metal Capillary Column UA1-60W x 0.53 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	60 m	0.5µm	380°C	CH-100161
Ultra ALLOY Metal Capillary Column UA1-60W x 0.53 mm ID, 1.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	60 m	1.5µm	380°C	CH-100162
Ultra ALLOY Metal Capillary Column UA1-60W x 0.53 mm ID, 5.0µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	60 m	5.0µm	380°C	CH-100163
Ultra ALLOY Metal Capillary Column UA5-15W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	15 m	0.25µm	380°C	CH-100164
Ultra ALLOY Metal Capillary Column UA5-15W x 0.53 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	15 m	0.5µm	380°C	CH-100165
Ultra ALLOY Metal Capillary Column UA5-15W x 0.53 mm ID, 1.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	15 m	1.5µm	380°C	CH-100166
Ultra ALLOY Metal Capillary Column UA5-15W x 0.53 mm ID, 5.0µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	15 m	5.0µm	380°C	CH-100167
Ultra ALLOY Metal Capillary Column UA5-30W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	30 m	0.25µm	380°C	CH-100168
Ultra ALLOY Metal Capillary Column UA5-30W x 0.53 mm ID, 0.50µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	30 m	0.50µm	380°C	CH-100169
Ultra ALLOY Metal Capillary Column UA5-30W x 0.53 mm ID, 1.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	30 m	1.5µm	380°C	CH-100170
Ultra ALLOY Metal Capillary Column UA5-30W x 0.53 mm ID, 5.0µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	30 m	5.0µm	380°C	CH-100171
Ultra ALLOY Metal Capillary Column UA5-60W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	60 m	0.25µm	380°C	CH-100172
Ultra ALLOY Metal Capillary Column UA5-60W x 0.53 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	60 m	0.5µm	380°C	CH-100173
Ultra ALLOY Metal Capillary Column UA5-60W x 0.53 mm ID, 1.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	60 m	1.5µm	380°C	CH-100174
Ultra ALLOY Metal Capillary Column UA5-60W x 0.53 mm ID, 5.0µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	60 m	5.0µm	380°C	CH-100175
Ultra ALLOY Metal Capillary Column UAWAX-15W x 0.53 mm ID, 1.0µm Film	Dimethyl polysiloxane	Strong polarity	0.53 mm	15 m	1.0µm	260°C	CH-100176

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UAWAX-30W x 0.53 mm ID, 1.0µm Film	Dimethyl polysiloxane	Strong polarity	0.53 mm	30 m	1.0µm	260°C	CH-100177
Ultra ALLOY Metal Capillary Column UAWAX-60W x 0.53 mm ID, 1.0µm Film	Dimethyl polysiloxaneDimethyl polysiloxane	Strong polarity	0.53 mm	60 m	1.0µm	260°C	CH-100178
Ultra ALLOY Metal Capillary Column UASIM(HT)-5W x 0.53 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	5m	0.1µm	380°C	CH-100179
Ultra ALLOY Metal Capillary Column UASIM(HT)-10W x 0.53 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	10 m	0.1µm	380°C	CH-100180
Ultra ALLOY Metal Capillary Column UAPHTA-15 m x 0.53 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.05µm	380°C	CH-100181
Ultra ALLOY Metal Capillary Column UAPHTA-30M x 0.53 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.05µm	380°C	CH-100182
Ultra ALLOY Metal Capillary Column UA624-30W x 0.53 mm ID, 3.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	30 m	3.0µm	320°C	CH-100183
Ultra ALLOY Metal Capillary Column UA624-60W x 0.53 mm ID, 3.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	60 m	3.0µm	320°C	CH-100184
Ultra ALLOY Metal Capillary Column UA624Dx-45W x 0.53 mm ID, 3.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	45m	3.0µm	320°C	CH-100185
Ultra ALLOY Metal Capillary Column UA1(S)-15W x 0.53 mm ID, 0.25µm Film	Polydimethylsiloxane	Nonpolar	0.53 mm	15 m	0.25µm	370°C	CH-100186
Ultra ALLOY Metal Capillary Column UA1(S)-30W x 0.53 mm ID, 0.25µm Film	Polydimethylsiloxane	Nonpolar	0.53 mm	30 m	0.25µm	370°C	CH-100187
Ultra ALLOY Metal Capillary Column UA1701-15W x 0.53 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	15 m	0.25µm	320°C	CH-100188
Ultra ALLOY Metal Capillary Column UA1701-30W x 0.53 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	30 m	0.25µm	320°C	CH-100189
Ultra ALLOY Metal Capillary Column UA1701-60W x 0.53 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	60 m	0.25µm	320°C	CH-100190
Ultra ALLOY Metal Capillary Column UA1701-15W x 0.53 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	15 m	0.5µm	320°C	CH-100191
Ultra ALLOY Metal Capillary Column UA1701-30W x 0.53 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	30 m	0.5µm	320°C	CH-100192
Ultra ALLOY Metal Capillary Column UA1701-60W x 0.53 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	60 m	0.5µm	320°C	CH-100193
Ultra ALLOY Metal Capillary Column UA1701-15W x 0.53 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	15 m	1.0µm	320°C	CH-100194
Ultra ALLOY Metal Capillary Column UA1701-30W x 0.53 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	30 m	1.0µm	320°C	CH-100195
Ultra ALLOY Metal Capillary Column UA1701-60W x 0.53 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	60 m	1.0µm	320°C	CH-100196
Ultra ALLOY Metal Capillary Column UA50-60W x 0.53 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	60 m	0.1µm	390°C	CH-100197
Ultra ALLOY Metal Capillary Column UA50-15W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	15 m	0.25µm	390°C	CH-100198
Ultra ALLOY Metal Capillary Column UA50-30W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	30 m	0.25µm	390°C	CH-100199
Ultra ALLOY Metal Capillary Column UA50-60W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	60 m	0.25µm	390°C	CH-100200
Ultra ALLOY Metal Capillary Column UA50-15W x 0.53 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	15 m	0.5µm	390°C	CH-100201
Ultra ALLOY Metal Capillary Column UA50-30W x 0.53 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	30 m	0.5µm	390°C	CH-100202
Ultra ALLOY Metal Capillary Column UA50-60W x 0.53 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	60 m	0.5µm	390°C	CH-100203

## Ultra ALLOY Metal Capillary Columns (continued)

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA50-15W x 0.53 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	15 m	1.0µm	390°C	CH-100204
Ultra ALLOY Metal Capillary Column UA50-30W x 0.53 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	30 m	1.0µm	390°C	CH-100205
Ultra ALLOY Metal Capillary Column UA50-60W x 0.53 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	60 m	1.0µm	390°C	CH-100206
Ultra ALLOY Metal Capillary Column UA65-15W x 0.53 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	15 m	0.1µm	390°C	CH-100207
Ultra ALLOY Metal Capillary Column UA65-30W x 0.53 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	30 m	0.1µm	390°C	CH-100208
Ultra ALLOY Metal Capillary Column UA65-60W x 0.53 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	60 m	0.1µm	390°C	CH-100209
Ultra ALLOY Metal Capillary Column UAWAX-15W x 0.53 mm ID, 0.5µm Film	Polyethyleneglycol	Strong polarity	0.53 mm	15 m	0.5µm	260°C	CH-100210
Ultra ALLOY Metal Capillary Column UAWAX-30W x 0.53 mm ID, 0.5µm Film	Polyethyleneglycol	Strong polarity	0.53 mm	30 m	0.5µm	260°C	CH-100211
Ultra ALLOY Metal Capillary Column UAWAX-60W x 0.53 mm ID, 0.5µm Film	Polyethyleneglycol	Strong polarity	0.53 mm	60 m	0.5µm	260°C	CH-100212
Ultra ALLOY Metal Capillary Column UAFFAP-15W x 0.53 mm ID, 0.5µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	15 m	0.5µm	260°C	CH-100213
Ultra ALLOY Metal Capillary Column UAFFAP-30W x 0.53 mm ID, 0.5µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	30 m	0.5µm	260°C	CH-100214
Ultra ALLOY Metal Capillary Column UAFFAP-60W x 0.53 mm ID, 0.5µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	60 m	0.5µm	260°C	CH-100215
Ultra ALLOY Metal Capillary Column UAFFAP-15W x 0.53 mm ID, 1.0µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	15 m	1.0µm	260°C	CH-100216
Ultra ALLOY Metal Capillary Column UAFFAP-30W x 0.53 mm ID, 1.0µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	30 m	1.0µm	260°C	CH-100217
Ultra ALLOY Metal Capillary Column UAFFAP-60W x 0.53 mm ID, 1.0µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	60 m	1.0µm	260°C	CH-100218
Ultra ALLOY Metal Capillary Column UAWAXK-15W x 0.53 mm ID, 0.5µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	15 m	0.5µm	260°C	CH-100219
Ultra ALLOY Metal Capillary Column UAWAXK-30W x 0.53 mm ID, 0.5µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	30 m	0.5µm	260°C	CH-100220
Ultra ALLOY Metal Capillary Column UAWAXK-60W x 0.53 mm ID, 0.5µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	60 m	0.5µm	260°C	CH-100221
Ultra ALLOY Metal Capillary Column UAWAXK-15W x 0.53 mm ID, 1.0µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	15 m	1.0µm	260°C	CH-100222
Ultra ALLOY Metal Capillary Column UAWAXK-30W x 0.53 mm ID, 1.0µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	30 m	1.0µm	260°C	CH-100223
Ultra ALLOY Metal Capillary Column UAWAXK-60W x 0.53 mm ID, 1.0µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	60 m	1.0µm	260°C	CH-100224

## Ultra ALLOY Guard Columns

Description	Part No.
Ultra ALLOY Guard Column Set Phthalates	CH-100225
Ultra ALLOY Guard Column Phthalates, Qty. 2	CH-100226
Ultra ALLOY Guard Column Connector, Qty. 1	CC-100336
Vent Free Metal Ferrule D, Qty. 20	CC-100337

## Ultra ALLOY 316 Stainless Steel Capillary Deactivated Tubes

Description	ID	Length	Part No.
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.15 x 0.47, 5M	0.15 mm	5 m	CT-100110
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 0.47, 5M	0.25 mm	5 m	CT-100111
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 1.58 (1/16"), 5M	0.25 mm	5 m	CT-100112
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.32 x 0.75, 5M	0.32 mm	5 m	CT-100113
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 0.75, 5M	0.53 mm	5 m	CT-100114
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 1.58 (1/16"), 5M	0.53 mm	5 m	CT-100115
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.15, 5M	0.80 mm	5 m	CT-100116
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.58 (1/16"), 5M	0.80 mm	5 m	CT-100117
Ultra ALLOY 316 SS Capillary Deactivated Tube 1.20 x 1.58 (1/16"), 5M	1.20 mm	5 m	CT-100118
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.15 x 0.47, 10M	0.15 mm	10 m	CT-100119
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 0.47, 10M	0.25 mm	10 m	CT-100120
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 1.58 (1/16"), 10M	0.25 mm	10 m	CT-100121
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.32 x 0.75, 10M	0.32 mm	10 m	CT-100122
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 0.75, 10M	0.53 mm	10 m	CT-100123
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 1.58 (1/16"), 10M	0.53 mm	10 m	CT-100124
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.15, 10M	0.80 mm	10 m	CT-100125
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.58 (1/16"), 10M	0.80 mm	10 m	CT-100126
Ultra ALLOY 316 SS Capillary Deactivated Tube 1.20 x 1.58 (1/16"), 10M	1.20 mm	10 m	CT-100127
Ultra ALLOY 316 SS EGA Capillary Tube 0.15 x 0.47, 2.5 M	0.15 mm	2.5 m	CT-100109

## Ultra ALLOY 316 Stainless Steel Untreated Capillary Tubes

Description	ID	Length	Part No.
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.15 x 0.47, 5M	0.15 mm	5 m	CT-100128
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 0.47, 5M	0.25 mm	5 m	CT-100129
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 1.58 (1/16"), 5M	0.25 mm	5 m	CT-100130
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.32 x 0.75, 5M	0.32 mm	5 m	CT-100131
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 0.75, 5M	0.53 mm	5 m	CT-100132
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 1.58 (1/16"), 5M	0.53 mm	5 m	CT-100133
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.80 x 1.15, 5M	0.80 mm	5 m	CT-100134
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.80 x 1.58 (1/16"), 5M	0.80 mm	5 m	CT-100135
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 1.20 x 1.58 (1/16"), 5M	1.20 mm	5 m	CT-100136
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.05 x 0.315, 10M	0.05 mm	10 m	CT-100137
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.15 x 0.47, 10M	0.15 mm	10 m	CT-100138
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 0.47, 10M	0.25 mm	10 m	CT-100139
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 0.47, 30M	0.25 mm	30 m	CT-100140
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 1.58 (1/16"), 10M	0.25 mm	10 m	CT-100141
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.32 x 0.75, 10M	0.32 mm	10 m	CT-100142
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 0.75, 10M	0.53 mm	10 m	CT-100143
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 1.58 (1/16"), 10M	0.53 mm	10 m	CT-100144